



UNITED STATES PATENT AND TRADEMARK OFFICE

cm

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/787,169	02/27/2004	Jun Wang	V9661.0056	4887

32172 7590 01/24/2008

DICKSTEIN SHAPIRO LLP
1177 AVENUE OF THE AMERICAS (6TH AVENUE)
NEW YORK, NY 10036-2714

EXAMINER

RAYMOND, BRITTANY L

ART UNIT	PAPER NUMBER
----------	--------------

1795

MAIL DATE	DELIVERY MODE
-----------	---------------

01/24/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/787,169	Applicant(s) WANG ET AL.	
	Examiner Brittany Raymond	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 December 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 7,9,10,12 and 15-20 is/are pending in the application.
4a) Of the above claim(s) 16-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 7,9,10,12 and 15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
2. Claims 7, 9, 10, 12 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pforr (U.S. Patent 6627392) in view of Baselmans (U.S. Patent Publication 2005/0136340) and Mori (U.S. Patent Publication 2004/0021841).

Pforr discloses a process of forming two masks from a denser patterned mask and imaging each mask pattern onto a substrate one after another (Column 4, Lines 15-23), as recited in claim 7 of the present invention. It is apparent from Figures 1 and 2 that features are placed onto a dense grid with rows and columns and the grid is split up into two sparser grids, one containing the first and fourth subsets of features and the other containing the second and third subsets of features, as described in claim 7 of the present invention. Pforr states that the original pattern has high-density structural detail

(Column 1, Lines 58-67), which is equivalent to saying the circuit area is minimized, as recited in claim 9 of the present invention.

Pforr fails to disclose that assist features are added to the grid points and that they are placed on the grid points that do not have real features on them, that the assist features are sized so that they do not print but allow illumination to be optimized, that the distance between two adjacent real features and the distance between two adjacent features is no less than minimum pitch of single-exposure lithography, and that quadrupole illumination sources with the poles of the quadrupole illuminations placed on the x-axis and y-axis are used for exposing the two masks.

Baselmans discloses a method of making a mask comprising: defining a plurality of pattern features and a plurality of assist features, each at selected locations (Paragraph 0023), as recited in claim 7 of the present invention. It is apparent from Figures 3 and 4 that the features are placed on a grid with even and odd-number columns and rows (first-fourth subsets as described in the claims of the present invention), and are spaced in a certain way or have particular grid pitches, as recited in claim 7 of the present invention. Figures 3 and 4 also show that the assist features are introduced at locations, 151, 152, etc., that do not have pattern features, as recited in claim 10 of the present invention. Baselmans also discloses that the assist features are not intended to appear in the pattern developed in the resist, but are used to improve the image (Paragraph 0019), as recited in claim 7 of the present invention. Baselmans states that a beam is projected through the mask to form a pattern on a substrate (Paragraph 0003), as recited in claim 7 of the present invention. Since only one

exposure is being performed through one mask, the features must be spaced so that the distance between two adjacent real features and the distance between two adjacent features is no less than minimum pitch of single-exposure lithography, as recited in claims 12 and 15 of the present invention.

Mori discloses a double exposure process which uses a quadrupole illumination source (Paragraphs 0067 and 0068), as recited in claim 7 of the present invention. Mori states that it is an off-axis illumination and it is apparent from Figure 3 that the poles of the quadrupole illuminations are on the x-axis and y-axis, as recited in claim 7 of the present invention.

It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have included sub-resolution assist features in the dense pattern of Pforr, as suggested by Baselmans, because Baselmans teaches that assist features allow for the pattern features to have improved critical dimensions. It also would have been obvious to one of ordinary skill in the art to have used a quadrupole illumination source with the poles of the quadrupole illuminations placed on the x-axis and y-axis for exposing the two masks of Pforr, as suggested by Mori, because Mori teaches that this type of illumination improves the resolving power so that a more accurate photoresist pattern can be formed.

Response to Arguments

3. Applicant's amendments have overcome the objections to claims 7 and 15 and the rejections of claims 12 and 15 under 35 USC 112 2nd paragraph that were presented in the last Office Action. Examiner has withdrawn the objections and rejections.

4. Applicant's arguments, filed 12/6/2007, have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, due to applicant's amendments, a new ground(s) of rejection is made in view of a newly found prior art reference.

Examiner has included the reference, Mori, to teach the use of a quadrupole illumination source with the poles of the quadrupole illuminations placed on the x-axis and y-axis for the exposure of the two masks. It would be obvious to combine Mori with Pforr and Baselmans because Mori teaches that the use of the off-axis illumination source allows for the resolution of the photoresist pattern formed in a double exposure process to increase. This would then allow for a finer pattern to be formed in the photoresist, which is the purpose of Pforr, Baselmans and the present invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brittany Raymond whose telephone number is 571-272-6545. The examiner can normally be reached on Monday through Friday, 8:30 a.m. - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Application/Control Number:
10/787,169
Art Unit: 1795

Page 6

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

blr



MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700